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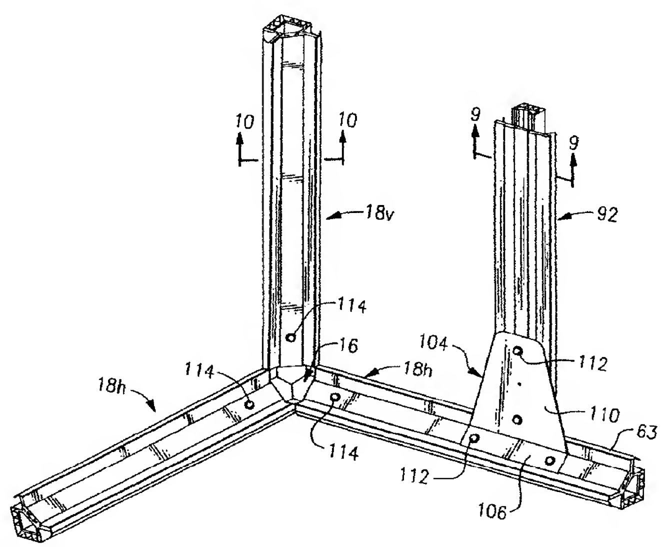
(54) **Title:** AIR HANDLER FRAMEWORK



(57) Abstract: A rectangular framework for a module for an air handling unit includes eight longitudinally extending structural elements (18) interconnected by eight one-piece corner connectors (16). Each of the longitudinally extending structural elements has a predetermined length, which may be different depending upon the size of the rectangular framework. Each of the elements includes a hollow extrusion formed from a metal material. The metal extrusion (26) defines an outer surface and an interior having open ends, which have a predetermined shape. A hollow extrusion (28) formed from a plastic material defines an interior cross-section having an interior surface which is configured to receive the metal extrusion therein with the outer surface of the metal extrusion in confronting relation with the inner surface of the plastic extrusion. The corner connectors are formed from a non-corrosive structural material.

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AIR HANDLER FRAMEWORK

Technical Field

The invention relates to a rectangular structural framework for a module for an air handling unit, which has all exterior surfaces formed from a non-corrosive material.

Background Art

Residential and commercial air conditioners include air handling units which include as a part thereof a heat exchanger and a fan, which cooperate to direct air to be heated and/or cooled across the heat exchanger for direction to an enclosed area to be heated and/or cooled. It is well known to make such air handing units in a modular manner, wherein the modular units have common dimensions, which allow them to be assembled in a variety of combinations depending upon the size of the installation and the location of the installation. The basic modules of such a system include a fan module, which typically includes a centrifugal fan and motor assembly, a coil module, which includes a heat exchange coil, and filter modules.

Typically such modular construction includes a substantially rectangular framework, which supports the inner components of the module and supports outer walls for enclosing the components. It is known in the prior art to define the structural framework by the use of eight corner connectors which are each adapted to receive three of the free ends of the eight horizontal and four vertically extending structural elements to thereby define a rigid solid rectangular support framework. This framework is adapted to removably receive and support outer wall panels as required for the particular construction of the module, i.e. as a fan

module, a coil module, or a filter module.

The horizontal and vertical elements for such a modular construction are typically formed from aluminum extrusions. Such metal components establish a heat transfer path between the interior of the air handling module and the exterior thereof. Such heat transfer path will result in loss of efficiency of the unit and also, during the air conditioning mode, will result in condensation of warm moist air on the exterior surfaces of the metal components. The moisture condensed on the outer components will corrode the components and may cause damage to adjacent structures or components. Accordingly, it is desirable to have air handling modules in which all components are non-corrosive and which have no direct metal-to-metal path from the interior to the exterior thereof.

Disclosure of the Invention

The invention relates to a rectangular framework for a module for an air handling unit. The framework comprises eight longitudinally extending structural elements interconnected by eight one-piece corner connectors. Each of the longitudinally extending structural elements has a predetermined length, which may be different depending upon the size of the rectangular framework. Each of the elements includes a hollow extrusion formed from a metal material. The metal extrusion defines an outer surface and an interior having open ends, which have a predetermined shape. A hollow extrusion formed from a plastic material defines an interior cross-section having an interior surface, which is configured to receive the metal extrusion therein with the outer surface of the metal extrusion in confronting relation with the inner surface of the plastic extrusion. The corner connectors are formed from a non-corrosive

structural material and each includes a central cube-shaped section. Three contiguous sides of the cube-shaped section cooperate to define an exterior corner. Three other contiguous sides each have extending therefrom a tubular element having a cross-section, which is configured to be received in a press-fit relationship within one of the open ends of one of the metal extrusions. The tubular elements each form a 90° angle with respect to each of the other two tubular elements. When the eight structural elements of selected predetermined lengths are assembled to the eight corner connectors to form the rectangular framework, all external surfaces of the framework are of a non-corrosive materials.

Brief Description of the Drawings

The invention may be better understood and its objects and advantages will become apparent to those skilled in the art by reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a fan module having a structural framework constructed according to the present invention;

Figure 2 is a perspective exploded view of the fan module of Figure 1;

Figure 3 is an enlarged detail showing of a corner connector and three adjacent structural elements of the framework shown in Figure 2;

Figure 4 is a view similar to Figure 3 having an intermediate structural element attached thereto;

Figure 5 is a view similar to Figure 4 taken from another angle thereof;

Figures 6 and 7 are exploded views of the structure illustrated in Figures 4 and 5, respectively;

Figure 8 is a perspective view of the intermediate structural element illustrated in Figures 4–7;

Figure 9 is a sectional view taken along the line 9-9 of Figure 4;

Figure 10 is a sectional view taken along the line 10-10 of Figure 4;

Figure 11 is a top view of a corner connector;

Figure 12 is a side view of a corner connector; and

Figure 13 is a perspective view of a corner connector.

Best Mode For Carrying Out The Invention and Industrial Applicability

A fan module for use with an air handling unit having a rectangular structural framework according to the present invention is illustrated in Figures 1 and 2. The modular construction of the fan module is typical of that known in the prior art and includes a substantially rectangular framework, which supports a pair of fans 12, a motor 14 and outer walls 15 for enclosing the inside components. The structural framework is defined by the use of eight one piece corner connectors 16, which are each adapted to receive three of the free ends of eight horizontal and four vertically extending elements 18 to thereby define a rigid solid rectangular support framework. As mentioned, the framework is adapted to removably receive and support outer wall panels 15, several of which are shown removed from the module 10 and others installed in Figure 2.

Figure 3 specifically illustrates one corner connector 16 from the structure illustrated in Figure 2, having two horizontal structural elements 18h and a vertical structural element 18v extending from the corner connector 16, as described above. It should be appreciated that the

basic structure of the structural elements 18 are substantially identical regardless of whether they are oriented in the vertical or horizontal orientation. The only differences are in the length of the elements, as necessary for the size of the module being built.

Each of the structural elements 18 includes an inner longitudinally extending aluminum extrusion 26, which is encased in an outer extrusion 28 made from a corrosion resistant material such as polyvinyl-chloride (PVC), which also has insulating properties greater than that of aluminum.

As best seen in Figure 10, the structural extrusion 26 includes a substantially square cross-section 30 defined by four walls 34. The upper left-hand corner of the square cross-section 30, as viewed in Figure 5, is truncated by a diagonally extending section 36. The cross-section thus defined extends the entire length of the extrusion 26 and thus defines openings having this cross-section at the open ends of the extrusion. The diagonal section 36 has an inner wall 38 interconnecting ends of two of the four walls 34 of the square section 30. As best seen in Figures 3 and 4, an outer wall 40 of the diagonal section 36 is spaced from the inner wall 38 and includes a longitudinally extending slot 42 therein, which extends the entire length of the extrusion 26. As will be seen, the inner wall 38 and the outer wall 40 define a longitudinally extending channel 43 therebetween which is accessible through the slot 42 in the outer wall 40. Extending from the upper right-hand end of the diagonal section 36 is a vertically extending support flange 44. Similarly, extending from the lower left-hand end of the diagonal section 36 is a horizontally extending support flange 46.

The outer PVC extrusion 28 completely surrounds the outer surface of the structural aluminum extrusion 26 described above. The outer channel 28 includes double wall vertical and horizontal sections 48 and 50, respectively, which interconnect with one another at a corner 52. Each of the double wall sections have a single wall section 54 and 56, respectively, extending from the other end thereof, which are in proximity to the two short wall segments 34 of the square cross-section 30. Extending vertically upwardly from the horizontal wall section 54 and horizontally from the vertical wall section 56 are single thickness walls 58 and 60, respectively, which are in confronting relation with one side of each of the vertical support flange 44 and the horizontal support flange 46. Formed at the outer ends of the walls 58 and 60 are longitudinally extending U-shaped channel sections 62 and 64, respectively. Extending from the ends of the channels 62 and 64 are vertical, and horizontal walls 66 and 68, respectively. The walls 66 and 68 complete the protective enclosure of the vertical support flange 44 and the horizontal support flange 46. The U-shaped sections 62 and 64 are configured to receive elongated rubber seals 63 therein, as shown in Figures 2–7, which serve to provide an air tight seal for the walls 15 when installed in the framework.

Interconnecting the ends of the walls 66 and 68 away from their U-shaped channel sections, is a substantially planar wall 70, which is in confronting relationship with the outer wall 40 of the diagonal section 36. As will be appreciated from the description that follows, the interconnecting wall 70 overlies and protects the outer wall 40 and substantially the entire length of the longitudinal slot 42 formed therein.

Looking now at Figures 11, 12 and 13, the corner connector 16 is shown in detail. Each corner connector includes a central cube-shaped section 72. Three contiguous substantially planar sides 74 of the cube-shaped section 72 cooperate to define corner 76 which, when the structural framework is assembled, define the outer corners of the framework. Extending outwardly from the other three contiguous sides of the cube-shaped section are three longitudinally extending tubular elements 78. Each of the tubular elements 78 has a major length thereof 80 which has a cross-section substantially identical to the cross-section defined by the four walls 34 and the diagonal inner wall 38 of the inner aluminum extrusion 26. The outer ends 82 of the tubular elements have substantially the same cross-section, but are tapered towards the end thereof to facilitate insertion of the tubular elements within the open ends of the aluminum extrusions 26.

As best seen in Figure 13, the planar wall 84 of the major section 80 of the tubular elements 78 is provided with a pair of longitudinally extending raised sections 86 thereon. The wall 84 and the raised sections 86 engage the outer wall 40 of the diagonal section 36 of the extrusion 26 when a tubular element 78 is press-fit therein to thereby assure positive retention of the tubular element once inserted. As best seen in Figures 11 and 13, the central cube-shaped section 72 defines a structure generally identified by reference numeral 88 surrounding the base of each of the tubular elements 78. The structure 88, which is configured to cooperate with the double wall vertical and horizontal sections 48 and 50 of the outer PVC extrusion and with the other wall sections 54 and 56 and 58 and 60, also formed by the PVC extrusion 28. As a result, when a

corner connector 16 has three structural elements 18 attached thereto, as described above, the outer surfaces of the outer cover 28 cooperate with the three planar sides 74 of the corner connectors to define a smooth transition therebetween, as best seen in Figures 5 and 7.

Each of the planar sides 74 of the connectors cube-shaped section 72 has an L-shaped cutout 90 in the inner corner thereof. Again, as best seen in Figures 5 and 7, these corner cutouts cooperate with the walls 54 and 56 and 58 and 60 to define the channels in which the outer walls 15 are received when the walls are mounted to the assembled rectangular framework. In a preferred embodiment, the corner connectors are made from structural nylon.

In the assembly of some modules where the size of the module requires structural elements 18 longer than two meters in length, it is desirable to install intermediate structural elements 92, as illustrated in Figures 4–9. The intermediate structural elements 92 are defined by a longitudinally extending aluminum extrusion 94 having a rectangular cross-section. The extrusion 94 is encased in a PVC extrusion 96. The PVC extrusion includes an outer double thickness wall 98 and two laterally extending double thickness sections 100 integrally formed therewith, which form L-shaped channels 102 for receiving wall sections 15 therein.

Prior to assembly of the intermediate structural elements 92 to the framework, the upper and lower ends are cut such that they will cooperate with the upper and lower structural elements 18 to which they are to be installed. The elements 92 are then positioned, as illustrated in Figures 4–7, and a mounting bracket 104 having a lower flange 106 configured to engage the structural elements 18 and an upper flange 110,

which extends along the backside of the structural element 92. The flanges are then appropriately secured to the structural element and the flange by threaded fasteners 112 extending from the inside of the rectangular framework through the PVC cladding of the two elements (92 and 18) and into their underlying aluminum structural channels (94 and 26).

Also, as will be noted in Figures 4–7, threaded fasteners are also inserted through the ends 112 of the structural elements adjacent the connectors such that they will pass through the structural element and into the tubular elements 78 of the corner connectors 16 to thereby assure positive attachment of these components to one another. It will be appreciated that none of the above-described threaded components passes from the interior to the exterior of the framework; rather, they pass from the interior through a structural element and into a hollow channel, which is insulated to thereby preserve the insulating properties of the framework, as described above.

CLAIMS

1. A rectangular framework for a module for an air handling unit, said framework comprising:

eight longitudinally extending structural elements, each having a predetermined length which may be different depending upon the size of the rectangular framework, each of said structural elements comprising:

a hollow extrusion formed from a metallic material, said metallic extrusion defining an interior having open ends having a predetermined shape, and defining an outer surface;

a hollow extrusion formed from a plastic material and defining an interior cross-section having an interior surface configured to receive said metal extrusion therein with said outer surface of said metal extrusion in confronting relation with said inner surface of said plastic extrusion;

eight one-piece corner connectors formed from a non-corrosive structural material, each of said connectors comprising:

a central cube-shaped section, three contiguous substantially planar sides of said cube-shaped section cooperating to define a corner, and, the other three contiguous sides each having extending therefrom a tubular element having a cross-section configured to be received in a press-fit relationship within one of said open ends of one of said metal extrusions, said tubular elements each forming a 90° angle with respect to each of the other two tubular elements;

whereby with said eight structural elements of predetermined lengths assembled to said eight corner connectors to form said rectangular

framework, all external surfaces of said framework being of a non-corrosive material.

2. The rectangular framework of claim 1 wherein said metallic extrusion is made from aluminum, said plastic material is polyvinyl-chloride, and said non-corrosive structural material from which said corner connectors are made is nylon.

3. The framework of claim 1 further including one or more intermediate structural elements interconnecting one or more pairs of parallel co-planar longitudinal structural elements;

each of said intermediate structural elements comprising:

a second hollow extrusion formed from a metallic material, and a second hollow extrusion formed from a plastic material, configured to receive said second metallic extrusion therein;

each of said intermediate structural elements having a first end configured to be positioned in contact with one of said pair of structural elements and a second end configured to be positioned in contact with the other of said pair of structural elements;

a pair of attachment plates configured to overlie a surface of each of said ends of said intermediate structural elements and the structural element with which it is in contact with; and

threaded fastener means for attaching said attachment plates to both said intermediate structural element and said structural element, said threaded fasteners extending from the interior of said framework through said attachment plates, through said second plastic extrusion and into said second metallic extrusion.

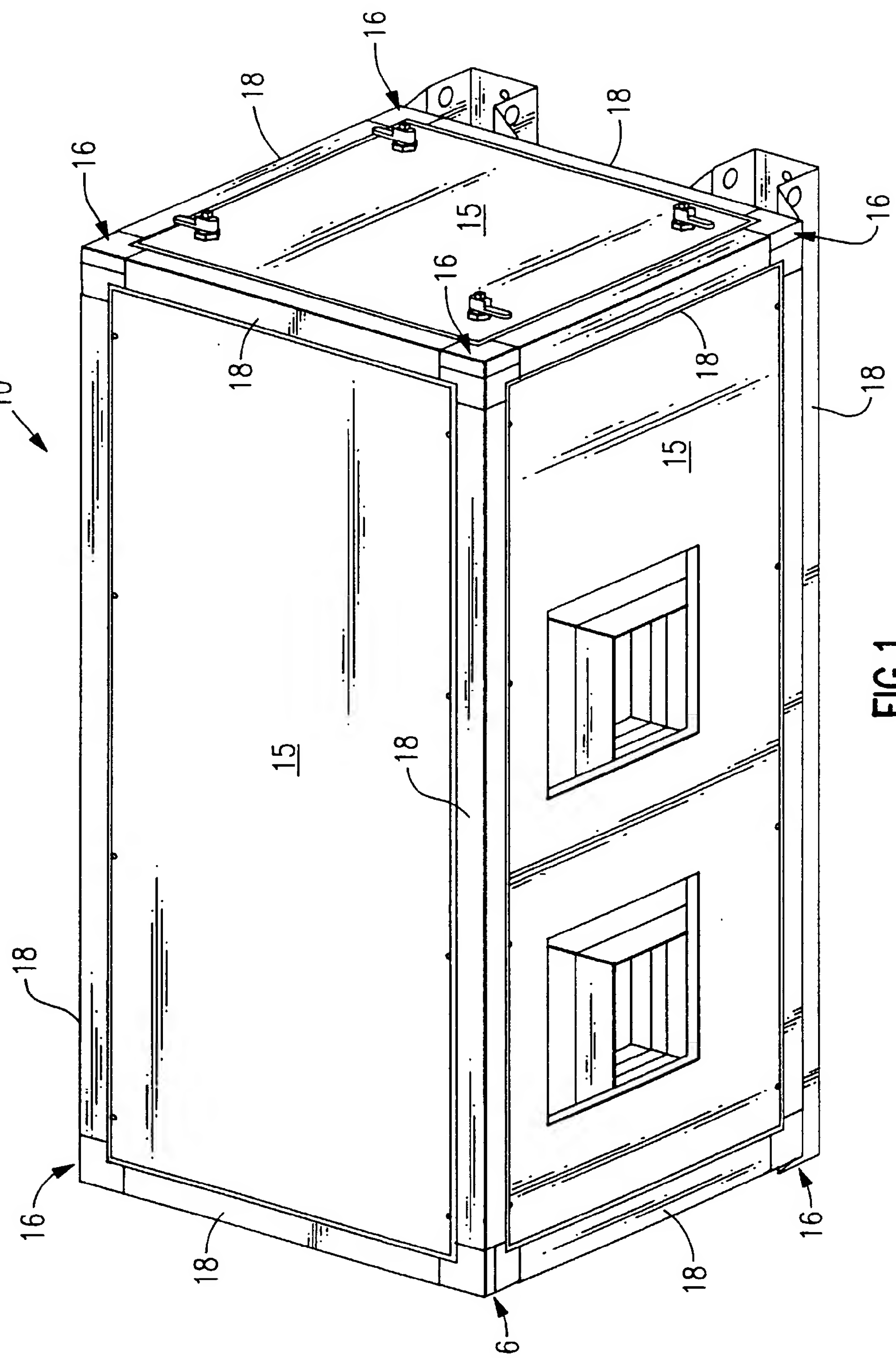

FIG.1

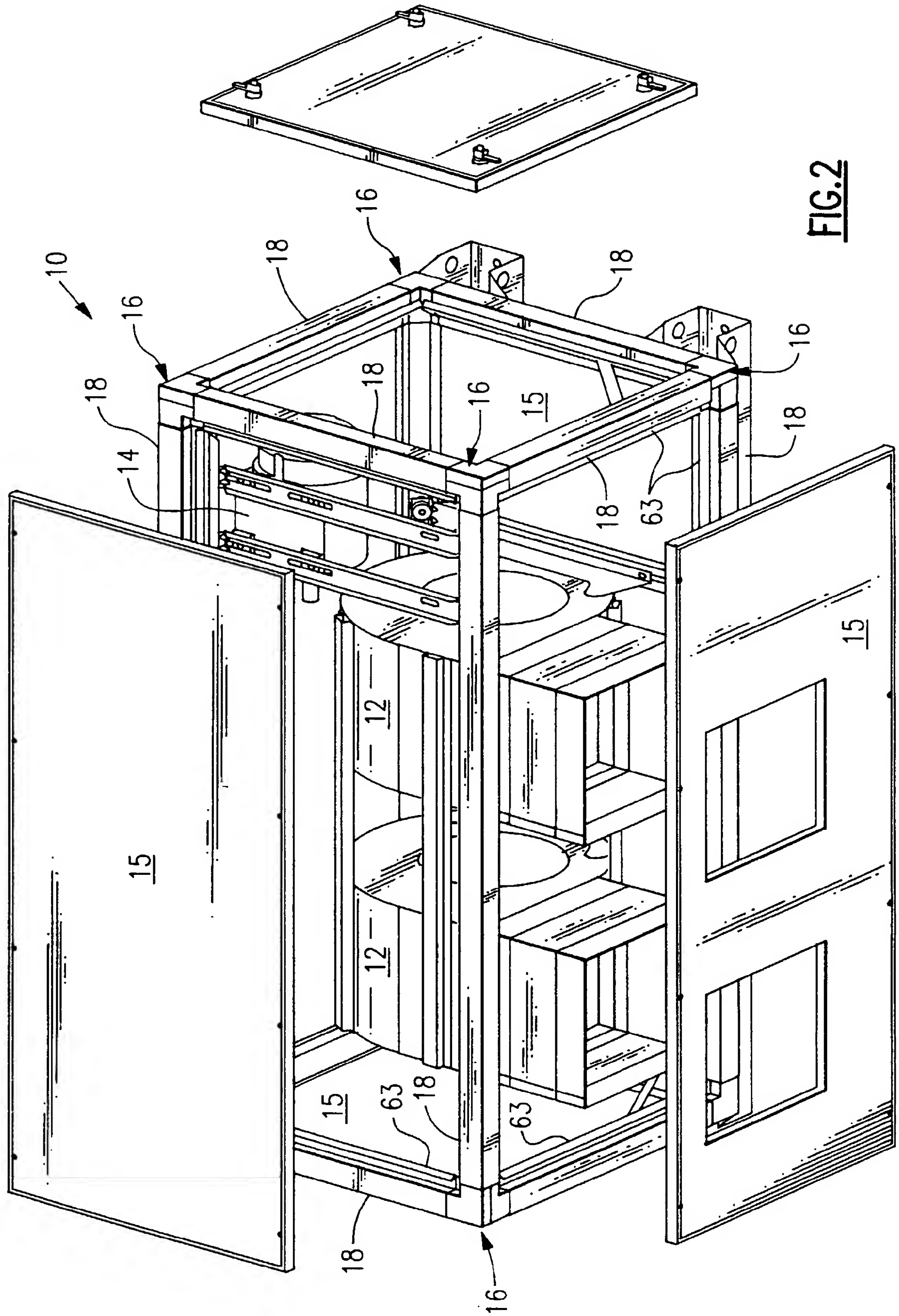

FIG.2

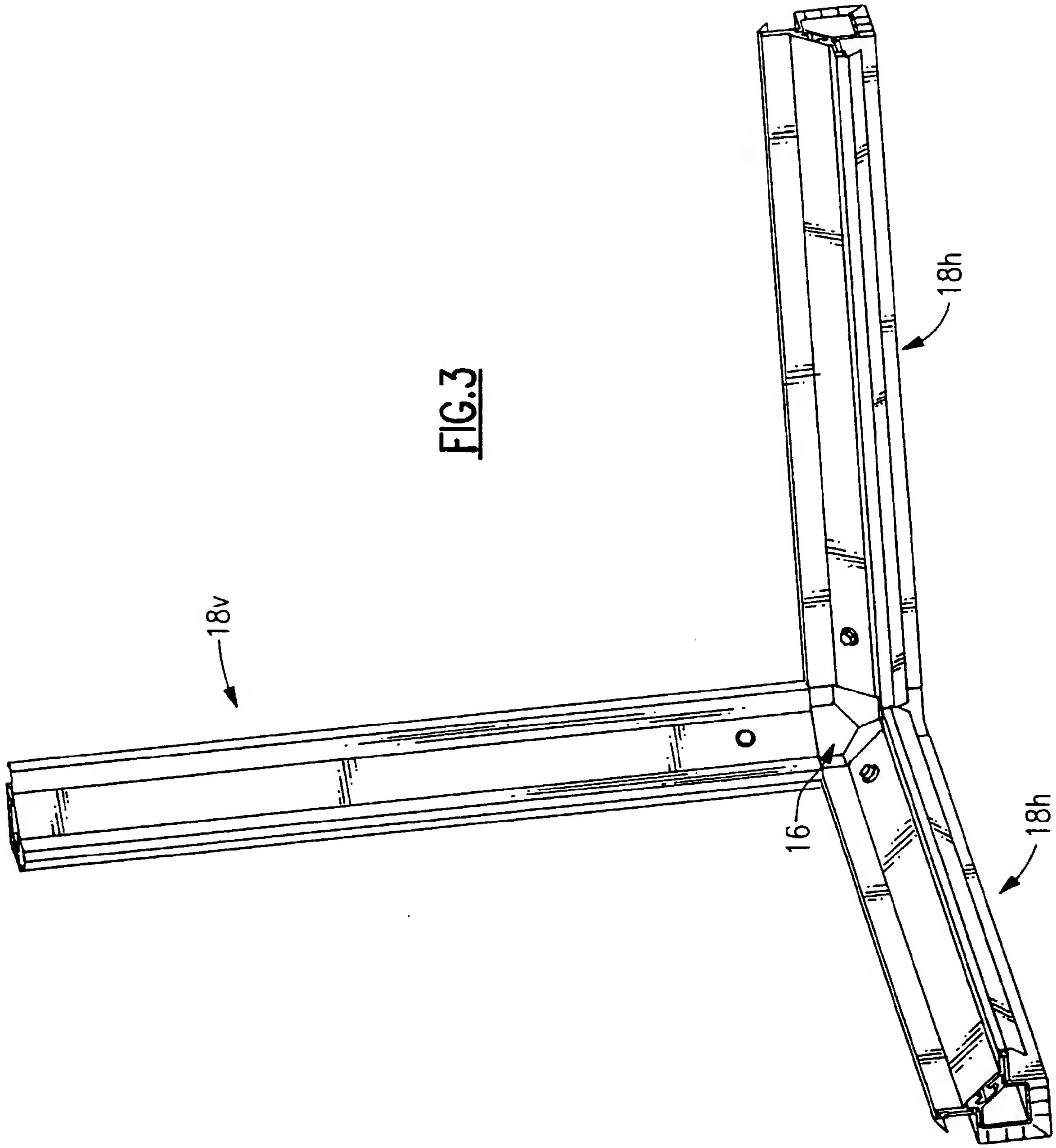

FIG.3

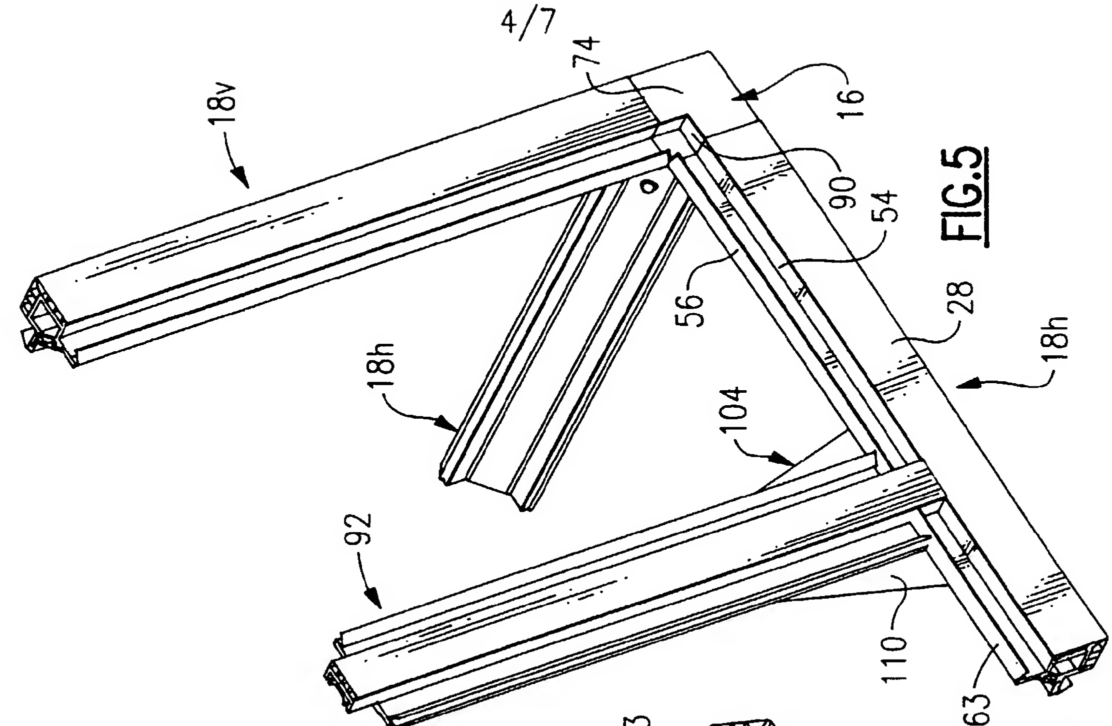
74
18v
16
90
54
56
28
18h
18h
104
92
110
63

FIG.5

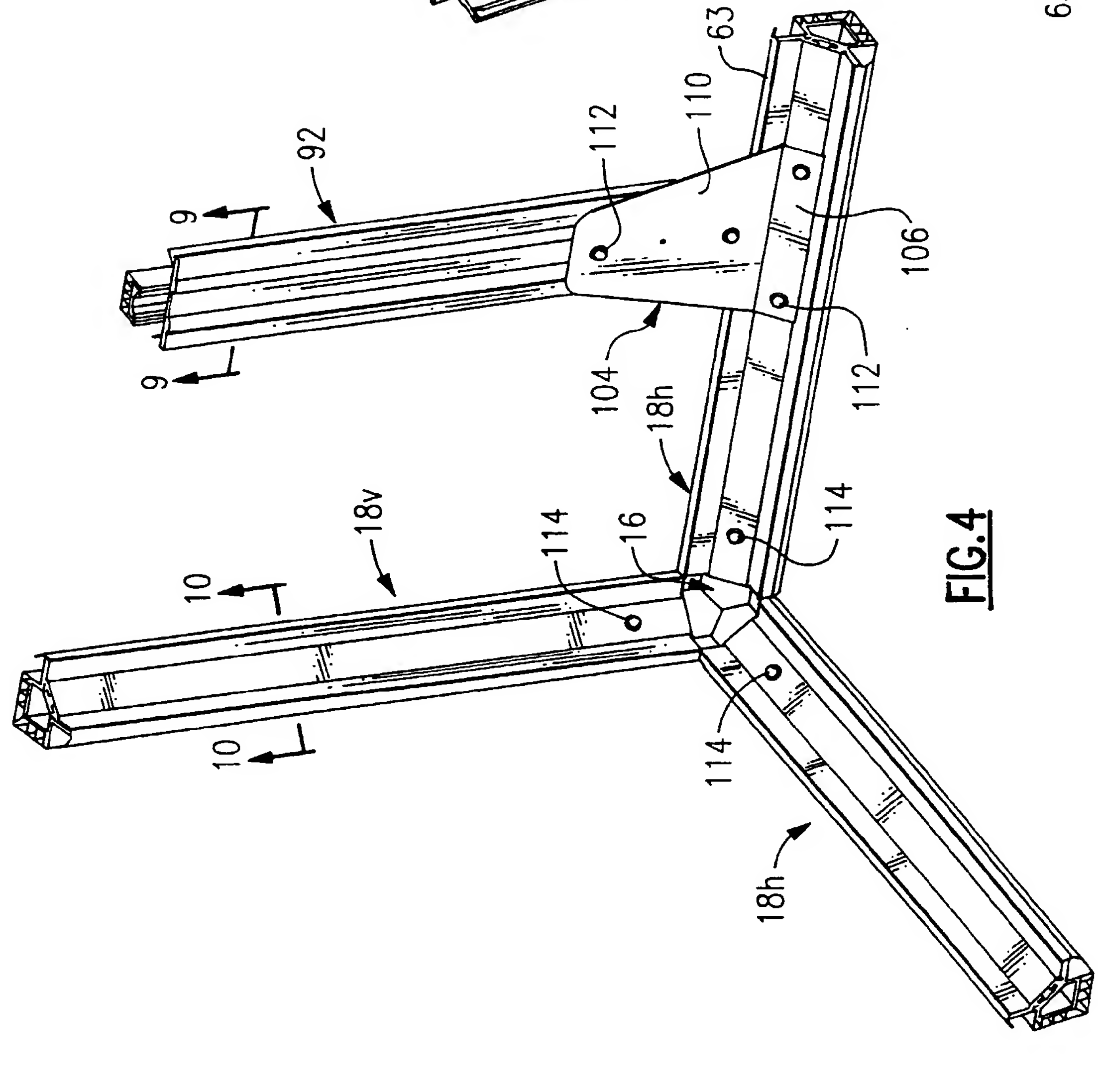
63
110
112
92
9
9
110
106
104
112
18h
112
18v
10
10
114
16
114
114
18h

FIG.4

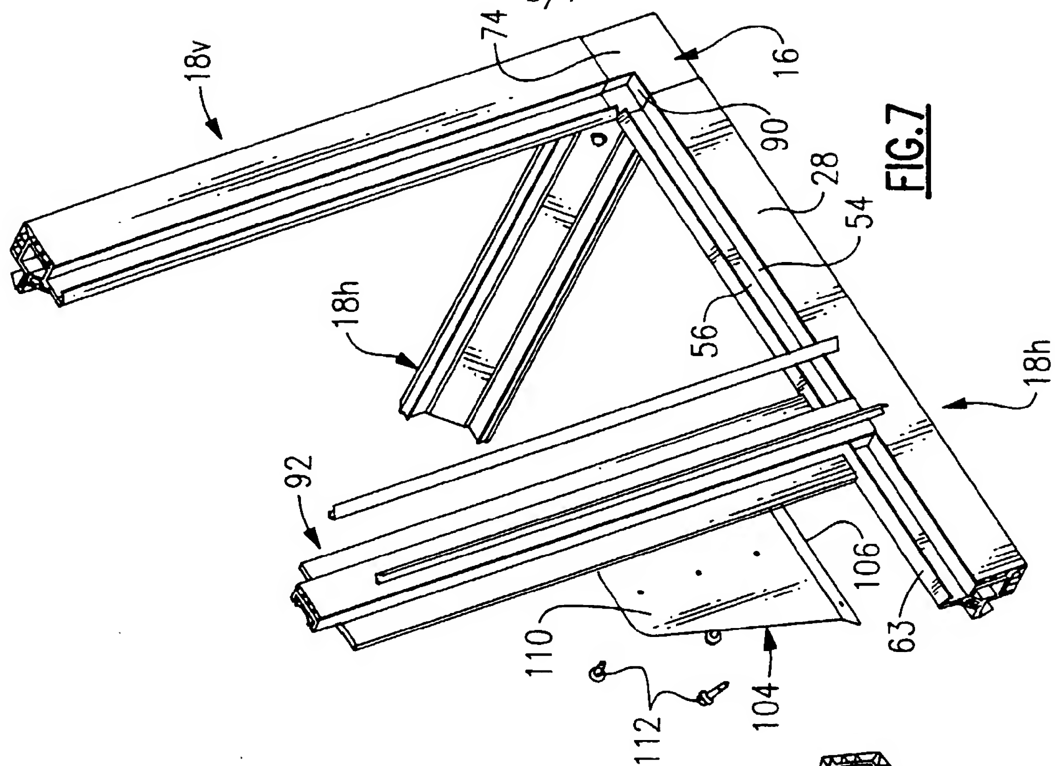
18v
74
16
90
28
54
56
18h
18h
92
106
110
63
112
104

FIG.7

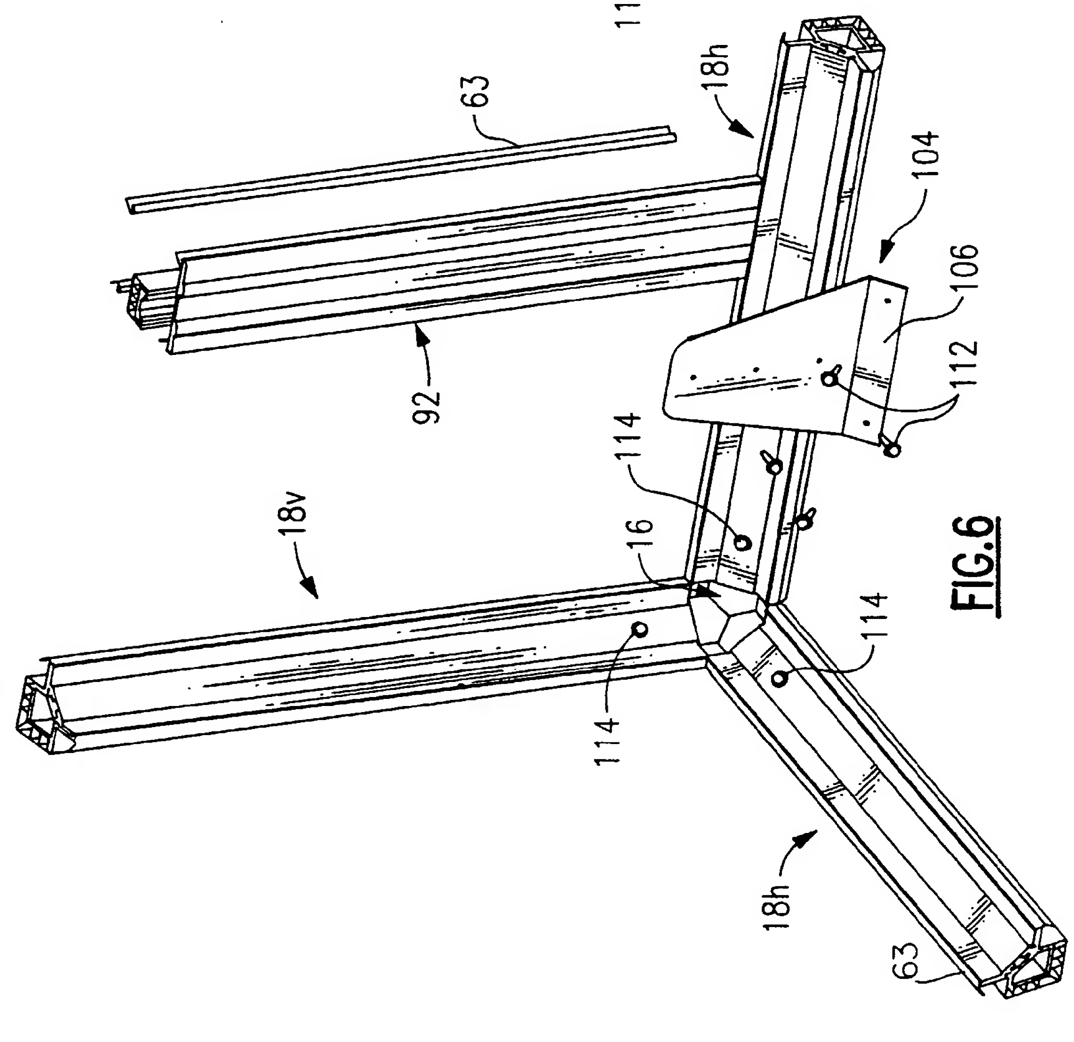
63
18h
104
106
92
112
114
18v
16
114
114
18h
63

FIG.6

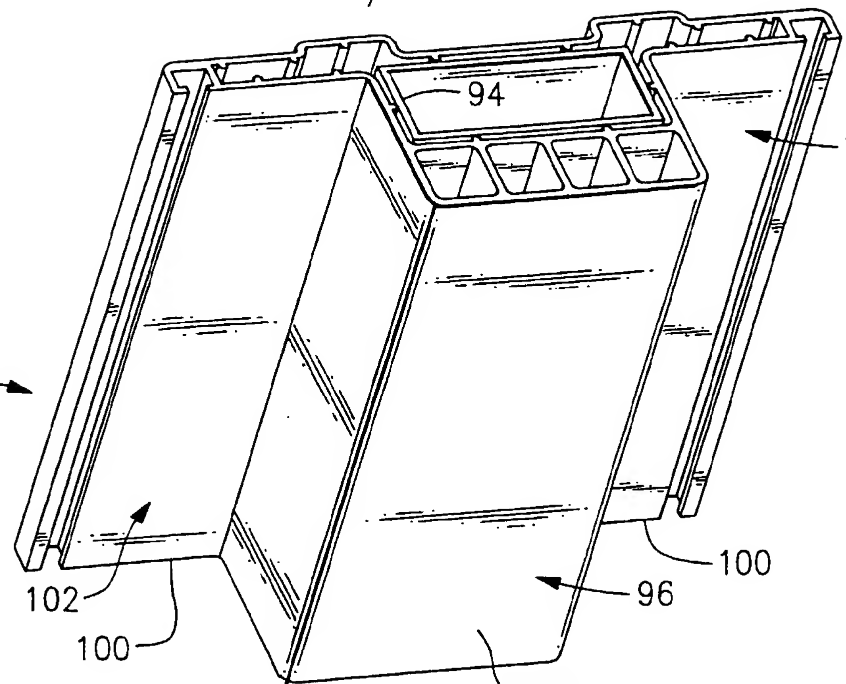

FIG.8

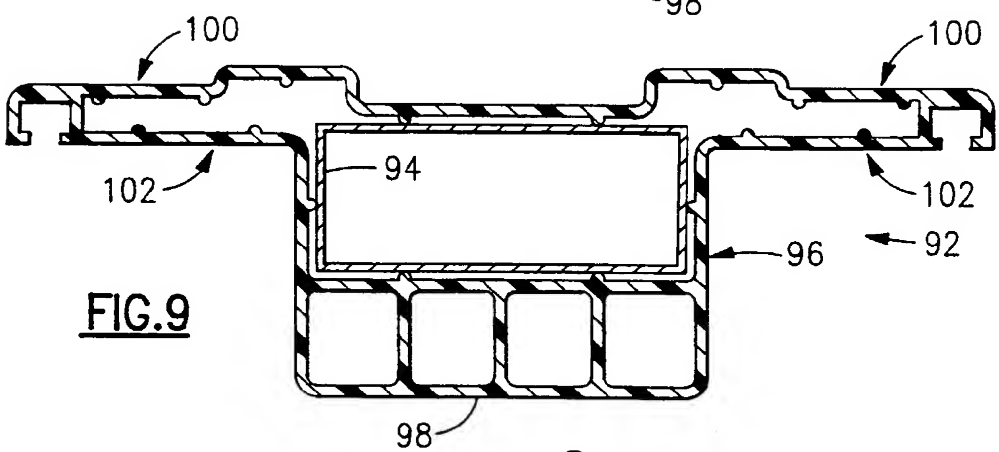

FIG.9

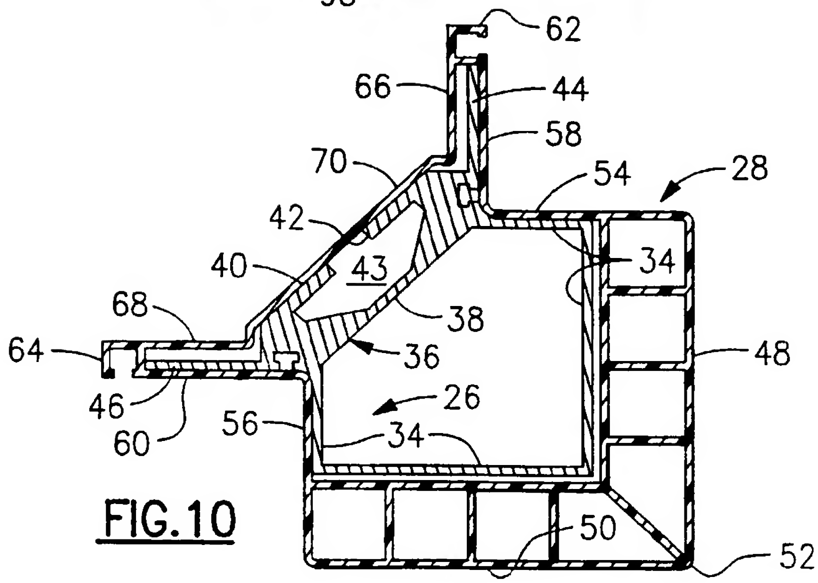

FIG.10

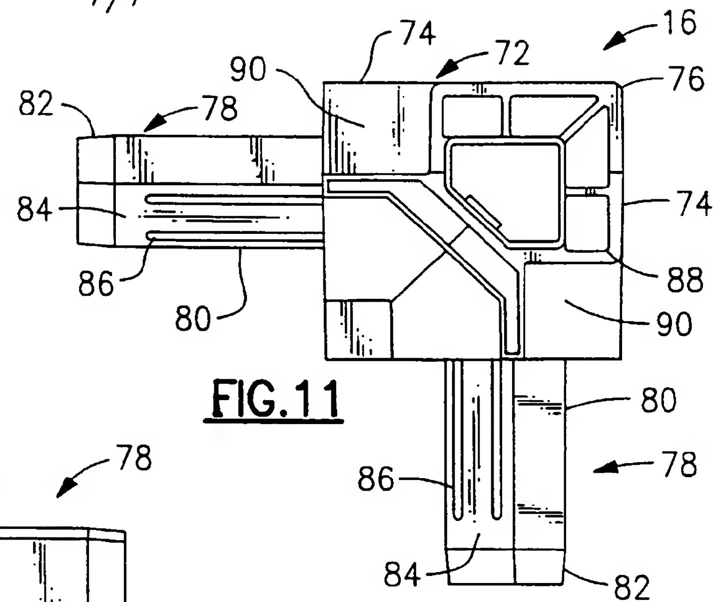

FIG.11

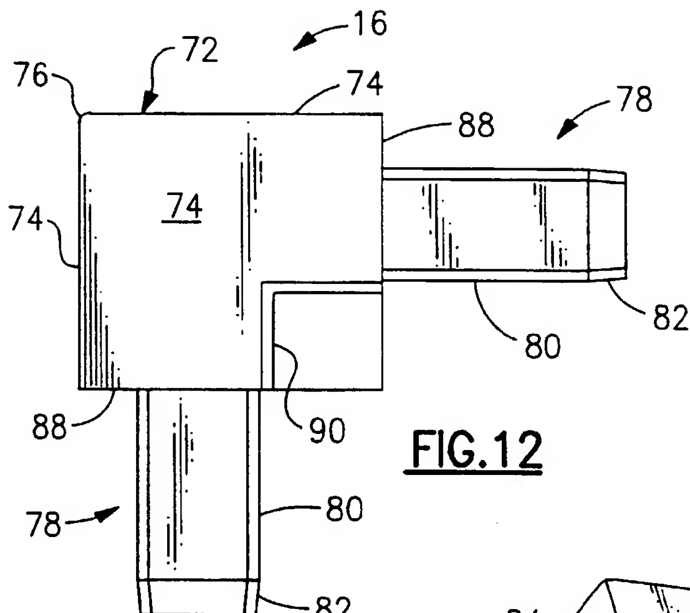

FIG.12

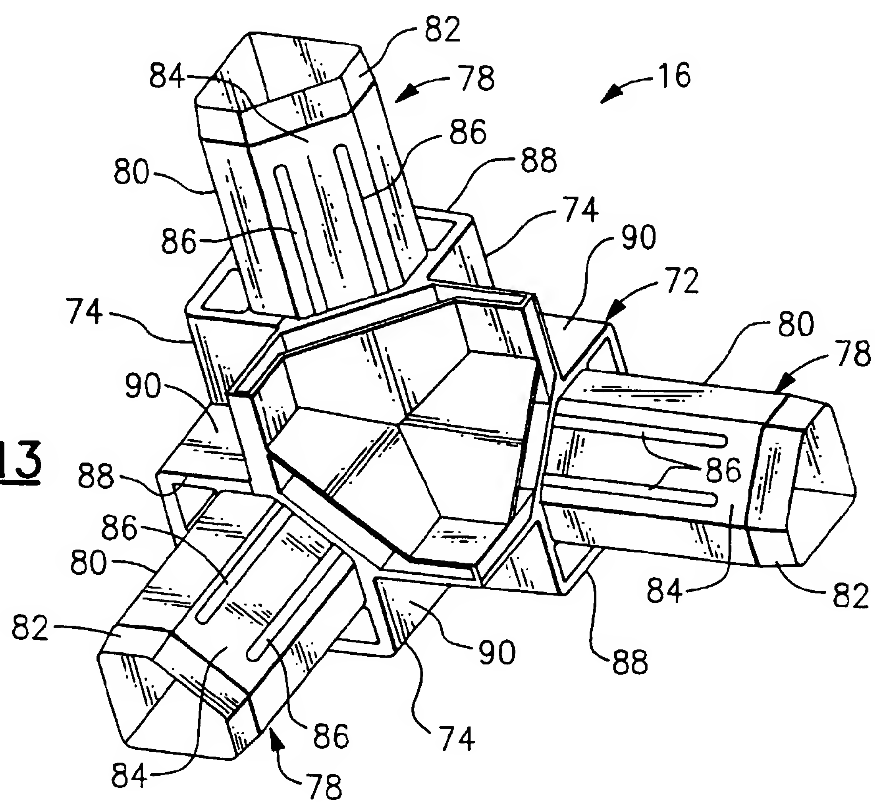

FIG.13